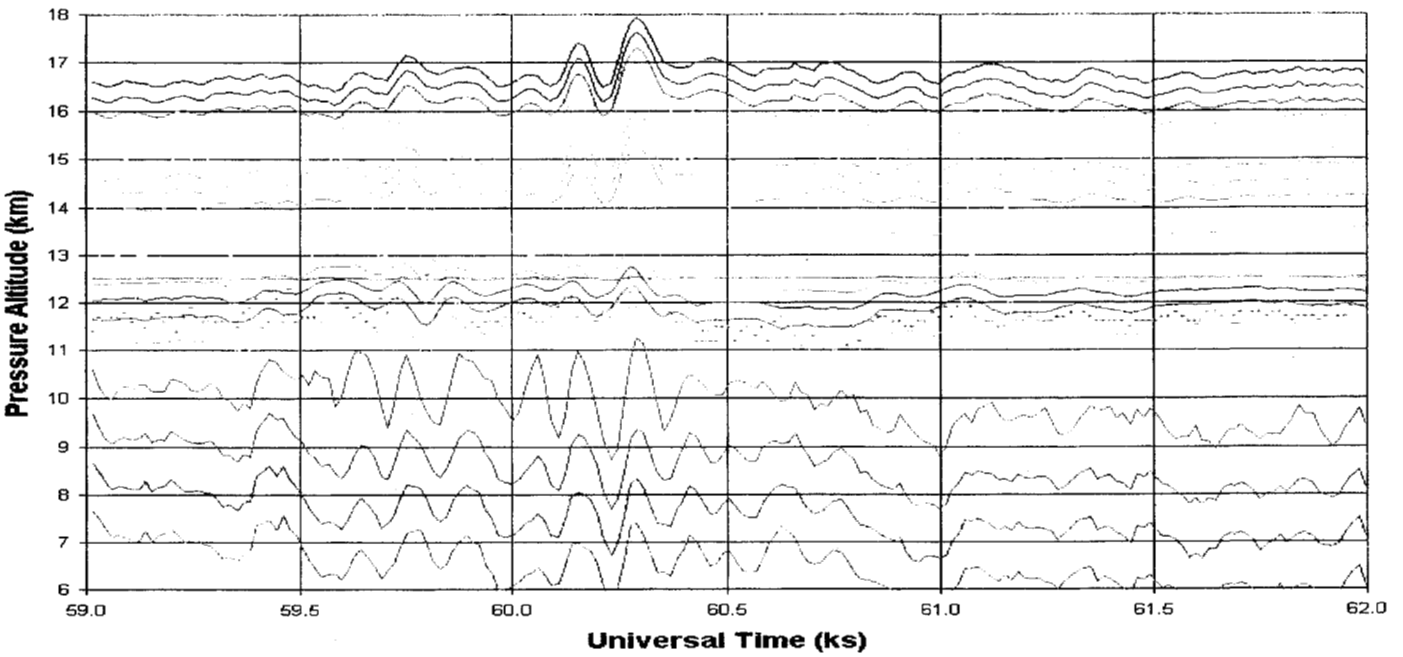
MTP Observations of Mountain Lee Waves during SOLVE

MJ Mahoney and Bruce Gary
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

JPL Microwave Temperature Profilers (MTPs), which were flown aboard the NASA ER-2 and DC-8 research aircraft during the SOLVE campaign, provide an extremely rich data set for validating mountain-wave models and understanding the influence of these waves on ozone depletion. The first MTP observation of mountain lee waves associated with mesoscale PSCs occurred in 1987 during the Airborne Antarctic Ozone Experiment (AAOE), and their implication for ozone depletion were recognized immediately[1].



The figure above illustrates MTP-derived potential temperature surfaces (from 300 K to 400 K in 5 K steps) for a DC-8 flight on January 25, 2000, over the Norwegian Mountains southwest of Kiruna. The solid red line is the DC-8 pressure altitude and the red points are thermal tropopause solutions. These waves are also seen in *in-situ* tracers, and point to the importance of dynamics in understanding tracer variability. This flight is noteworthy in that the mountain lee waves seen here are the largest amplitude ever recorded by a MTP, breaking the record set during AAOE thirteen years earlier. Such waves were observed on several occasions during this flight. Furthermore, based on analysis to date for half of the DC-8 flights, mountain waves with an amplitude >200 m and at least two peaks (or valleys) separated by <1000 s were present for more than 8% of the flight hours. Based upon a global mountain-wave model, it has previously been noted[2] that mountain waves offer a possible explanation for the under-prediction of ozone depletion rates calculated by three-dimensional models of the Arctic stratosphere. The rich MTP data set presented here will help put this on an observational footing.

[1] Bruce L. Gary, Observational Results Using the Microwave Temperature Profiler During the Airborne Antarctic Ozone Experiment, J. of Geophysical Research, 94(D9), 11,223-11,231, 1989.

[2] K. S. Carslaw, M. Wirth, A. Tias, B. P. Luo, A. Dörnbrack, M. Leutbecher, H. Volkert, W. Renger, J. T. Bacmeister, E. Reimers, & Th. Peter, Increased stratospheric ozone depletion due to mountain-induced atmospheric waves, Nature, 391, 675-678, 1998.